Amendments to the Claims:

1 (Currently Amended): A multi-frequency interferometry method for measuring the absolute phase of an electromagnetic wave, wherein the method comprises:

selecting a target measurement range, L, within which absolute phase measurements are desired to be made, said phase measurements being related to a desired measurand of an object;

determining a level of phase noise which will be present in wrapped phase measurements which will be made;

for the selected target measurement range, and the determined phase noise level, calculating an optimum number, N, of wavelengths of electromagnetic radiation to be used in the multi-frequency interferometry, where $N \geq 3$;

selecting an optimum series of values of said N wavelengths to achieve optimum noise immunity in wrapped phase measurements to be made; and

using a computing system to carry ~~carrying~~ out multi-frequency interferometry at the selected values of the N wavelengths so as to produce and record ~~make~~ at least one wrapped phase measurement at each of the N wavelengths, which recorded wrapped phase measurements are thereafter processed by the computing system to obtain an absolute phase measurement related to the desired measurand of the object.

2 (Original): The method according to claim 1, wherein the optimum number, N, of wavelengths is the minimum number of wavelengths required to obtain unambiguous phase measurements in the selected target measurement range, for the determined phase noise level.

3 (Original): The method according to claim 1, wherein the method includes proposing a measure of process reliability associated with the determined phase noise level, corresponding to a known probability of success in fringe order identification.

4 (Original): The method according to claim 3, wherein the proposed process reliability is σs, where σ is the standard deviation noise in a discrete level heterodyne function generated from the wrapped phase measurements made at two different wavelengths.

5 (Original): The method according to claim 3, wherein the proposed process reliability is used to calculate the minimum number, N, of wavelengths required to obtain unambiguous phase measurements in the selected target measurement range.

6 (Original): The method according to claim 1, wherein the processing of the wrapped phase measurements includes heterodyne processing.

7 (Original): The method according to claim 6, wherein the heterodyne processing produces a plurality of discrete level heterodyne functions each containing equal numbers of levels in the interval $-\pi$ to $+\pi$.

8 (Original): The method according to claim 1, wherein the processing of the wrapped phase measurements includes iterative unwrapping.

9 (Original): The method according to claim 1, wherein the selected values of said N wavelengths define a geometric series.

10 (Original): The method according to claim 1, wherein the selected values of said N wavelengths are such that they can be combined in a predetermined manner to generate a geometric series of synthetic wavelengths.

11 (Original): The method according to claim 10, wherein the selected values of said N wavelengths are heterodyne processed to generate the geometric series of synthetic wavelengths.

12 (Original): The method according to claim 11, wherein the selected values of the N wavelengths are chosen such that only one heterodyne operation is required to generate each synthetic wavelength in the geometric series.

13 (Original): The method according to claim 10, wherein the values of said N

wavelengths are selected in accordance with the following equation:

$$1/\lambda_1 = 1/\lambda_0 - (1/\lambda_0)^{i-1/N-1}(1/L)^{N-i/N-1}$$

where i=1,...,N, where N is the number of wavelengths, λ_0 is the wavelength associated with the largest frequency, and λ_i is the wavelength of the ith frequency, and L is the target measurement range.

14 (Original): The method according to claim 1, wherein the method is used for measuring the three-dimensional shape of an object which may have surface discontinuities, and the target measurement range is the range over which absolute depth measurements relating to the profile of the object are desired.

15 (Original): The method according to claim 14, wherein the step of carrying out the multi-frequency interferometry comprises:

recording a series of fringe patterns obtained when the object is illuminated with electromagnetic radiation at each of the selected N optimum wavelengths;

processing the recorded fringe patterns so as to obtain wrapped phase measurements in the form of a wrapped phase map for each of the N optimum wavelengths, and processing the wrapped phase maps to determine absolute fringe orders in the fringe patterns.

16 (Original): The method according to claim 15, wherein the absolute fringe orders are calculated using at least one of heterodyne processing, recursive unwrapping and iterative unwrapping of the wrapped phase maps.

17 (Original): The method according to claim 15, wherein at each said optimum wavelength a series of phase-stepped fringe patterns is recorded.

18 (Original): The method according to claim 1, wherein the multi-frequency

interferometry is carried out using fringe projection, and the selected series of N optimum wavelengths are synthetic wavelengths projected on to the object.

19 (Original): The method according to claim 18, wherein the selected values of the N synthetic wavelengths projected on to the object define a geometric series given by $(N_{f_0})^{\frac{i-1}{\lambda-1}}$, for $i=1,2,\ldots,\lambda$, where λ is number of wavelengths and N_{f_0} is the number of projected fringes in the largest fringe set.

20 (Original): The method according to claim 18, wherein the values of the N synthetic wavelengths projected on to the object are selected in accordance with the following equation:

$N_{f_i} = N_{f_0} - (N_{f_0})^{\frac{i-1}{\lambda-1}}$, for $i=1,2,\ldots,\lambda$

where λ is the number (l = N) of projected wavelengths, N_{f_0} is the number of projected fringes in the largest fringe set, and N_{f_i} is the number of projected fringes in the i^{th} fringe set.

21 (Original): The method according to claim 18, wherein the number, N, of wavelengths is equal to three, and the selected values of the three wavelengths are N_{f_0}, $N_{f_0} - \sqrt{N_{f_0}}$, and $\sqrt{N_{f_0}} - 1$, where N_{f_0} is the number of projected fringes in the largest fringe set.

22 (Original): The method according to claim 1, wherein the object is illuminated separately and sequentially with each of the selected optimum wavelengths of electromagnetic radiation.

23 (Original): The method according to claim 14, wherein the object is illuminated with white light and a plurality of said fringe patterns are captured simultaneously by recording them

with an image detector which can simultaneously capture image data at the selected optimum wavelengths.

24 (Original): The method according to claim 23 wherein the image detector is a colour camera.

25 (Original): The method according to claim 1, wherein the method is carried out in a single point ranging system in which the absolute phase measurements made are used to calculate absolute range.

26 (Original): The method according to claim 25, wherein the multi-frequency interferometry is carried out by illuminating the object using a broadband femtosecond laser.

27 (Original): The method according to claim 26, wherein the spectral range of the broadband pulses emitted by the laser is chosen so as to include the said optimum series of values of said N wavelengths.

28 (Original): A method of measuring absolute fringe order in a phase measuring sensor, wherein the method comprises:

selecting a number, N, of wavelengths of electromagnetic radiation to be used to illuminate an object, where $N \geq 3$;

determining a level of phase noise which will be present in wrapped phase measurements which will be made;

for the selected number, N, of wavelengths, and the determined phase noise level, selecting optimum values of the N wavelengths so as to achieve a maximum measurement range in which wrapped phase measurements can be made relating to a desired measurand of the object to be illuminated;

recording a series of fringe patterns obtained when the object is illuminated with electromagnetic radiation at each of the selected N optimum wavelengths; and

processing the recorded fringe patterns to obtain at least one wrapped phase

measurement at each of the selected N optimum wavelengths, and processing the wrapped phase measurements to determine absolute fringe orders in the fringe patterns.

29 (Currently Amended): A multi-frequency interferometer apparatus for shape measurement, comprising:

fringe projection means for generating a projected wavelength of illumination by projecting a predetermined fringe pattern on to an object; and

image capture and recording means for capturing and recording a deformed fringe pattern obtained when said predetermined fringe pattern is projected on to the object, the image capture means being disposed at an angle to the direction of illumination of the object with the projected fringe pattern; and

data processing means for processing recorded deformed fringe patterns so as to obtain phase measurements therefrom; wherein

the fringe projection apparatus generates ~~is variable such that~~ an optimum series of projected wavelengths ~~may be generated~~, the values of the wavelengths being such that, for a known level of phase noise in the apparatus, and a chosen number of projected wavelengths in said series, absolute fringe orders in the deformed fringe patterns are measurable over a maximum measurement range.

30 (Original): The apparatus according to claim 29, wherein the fringe projection means comprises a coherent fibre fringe projector for producing a pattern of Young's fringes across the object.